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(54) Secure data management system

(57) The present invention provides a system to ensure security of data in a computer network system. A center certifies a public-key of user of the system and distributes a secret-key. A first system comprises the center in a network, an information provider and a plurality of users. The center identifies utilization status by requests of the secret-key. The data is encrypted by the secret-key and is stored and transferred, while the data to be stored and transferred is encrypted by a secret-key different from the secret-key for the transferred data. An original data label is added to the original data, and an edit label is added to the edited data, and the center does not store the data and stores only the original data label and the edit label. A second system comprises a center and an information provider in a network, and a plurality of users utilizing the network. The center stores the original data and editing scenario, and also the original data label, user label and edit label. The data is not transferred between the users, but data label encrypted by the public-key is transferred. In electronic commerce system, every data is distributed through a mediator in the network, data which is transferred from a maker to a user is encrypted by a secret-key for encryption, and data which is transferred from the user to the maker is encrypted by a secret-key for re-encryption.

Fig. 3A

Fig. 3B

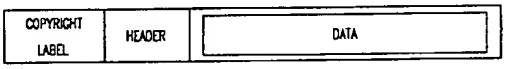

Fig. 3C

Fig. 3D

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Description

BACKGROUND OF THE INVENTION

The present invention relates to a data management system for managing digital data, and in particular to a system, which can be effectively applied to copyright management of copyrighted data, electronic commerce and digital cash.

As more and more information is available, database systems wherein many computers, which independently have stored various data, are connected via communication lines to use the data mutually are becoming increasingly popular. Such database system has been so far possible to process only coded information containing a small amount of information which can be processed by conventional computers and at the most monochrome binary data such as facsimile information, and faing to handle natural and moving pictures that include a substantially large amount of information.

Digital processing techniques for various electric signals are being developed, and efforts are being made to apply such techniques to those dynamic picture signals other than binary data which were processed as analog signals. Since the digitization of picture signals enables picture signals such as television signals to be handled by computers, people are viewing as a promising technique a "multimedia system" that can deal with both various data that can be processed by computers and picture data that is digitized picture signals.

Since picture data contains a significantly larger amount of information than character data or audio data, it cannot be stored, transmitted, or subjected to various processings by computers in its original form. Attempts have thus been made to compression/expansion of picture data, and some picture data compression/expansion standards have been prepared. These standards include the following common standards: the Joint Photographic Image Coding Experts Group (JPEG) standards for still pictures, the H.261 standards for video conferences, the Moving Picture Image Coding Experts Group 1 (MPEG1) standards for picture storage, and the MPEG2 standards for both existing television broadcasting and future high-definition television broadcasting. These techniques have enabled digital picture data to be processed in real-time.

Since analog data, which is conventionally popular, is degraded each time it is stored, copied, edited, and transmitted, little notice has been taken of the control of the copyright associated with these operations. Digital data, however, is not degraded after repeated storing, copying, editing, and transmission, such control of the control of the copyright associated with these operations is significant. There has been no adequate method for controlling the copyright for digital data; the copyright is managed based on the copyright law or relevant contracts. The copyright law simply establishes a compensation system for digital recording or equipment thereof.

A database not only has its contents referenced but is also used to effectively use data obtained through storing, copying, and editing, and it is possible to transfer edited data to a different user via on-line basis such as a communication line or via off-line basis using appropriate recording medium or to transfer it to the database to be registered as new data. Although conventional databases have dealt with only character data, databases in multimedia system contain audio and picture data that are inherently analog, in addition to databased character data.

Under these circumstances, the control of the copyright for data in databases is very important, but no copyright management means that is particularly applicable to secondary use such as copying, editing, and transmission has been completed.

In data communication using computers has been carried out in relatively small scale in the past, computer communication system called "Internet" has shown rapid progress in the past several years, and it is now being developed to a system closer and familiar to everybody. The information used in communication of this Internet system has been initially limited to character information only, but, with the progress of technique, audio data and picture data are now used. At present, even electronic commerce data or digital cash data, for which reliability and confidentiality are important factors, are now being used in the Internet system.

Under such circumstances, it has become necessary to establish new techniques to ensure and guarantee security to keep confidentiality and reliability of the processed data and also of the case where it is necessary to charge and collect a fee.

In the information data, i.e. copyrighted data, for which fee is charged when utilizing such data, copyright is asserted in most cases, while there are information data such as personal mail, advertisement and propaganda data, etc., for which copyright is not positively asserted. For example, in case of a personal mail, for which copyright is not asserted, it is important to maintain privacy and to prevent falsification or forgery of the contents. Even in the data for advertisement and propaganda, which is usually not associated with assertion of copyright, damage or impairment may often occur due to falsification of the contents or business activities may be disturbed because of distribution of the data to the people other than those originally aimed or such trouble may be caused by false data.

As described above, it is essential in case of personal mail to stop falsification of contents, to prevent infringement of privacy and to exclude forgery. For the advertisement and propaganda data, it is necessary to prevent falsification of data contents, to restrict looking and to exclude forgery.

The prevention of infringement of privacy in the personal mail and th restriction of looking of the advertisement and propaganda data can b achieved by

encryption of data. The prevention of forgery of the personal mail and the advertisement and propaganda data and the exclusion of falsification of the personal mail and the advertisement and propaganda data can be attained by confirmation (certification) of the sender or the transmitter of the data.

The Internet system is based on grass-roots concept and is a very fragile system as far as security of the system itself is concerned. Various systems for maintaining security of the Internet system have been proposed, and typical systems are PEM (Privacy Enhanced Mail) adopting hierarchical structure and PGP (Pretty Good Privacy) adopting horizontal distributed structure. These systems are effective to maintain confidentiality of data and to provide certification of the transmitting source, certification on non-falsification of the data, display of the first transmitter and control of public-key, while it is not possible by these systems to restrict re-utilization of data including data editing.

PEM, adopting hierarchical structure, comprises the most upper-level authority called IPRA (Internet PCA Registration Authority), a next upper-level authority called PCA (Policy Certification Authority), and the most lower-level authorities called Organizational, Residential and Personal respectively. Upper-level certification authorities issue a public-key certificate with digital signature on the data such as name of the lower-level authority for public-key of the lower-level authority, thus guaranteeing validity of the public-key.

PGP, adopting horizontal distributed structure, has no entity to correspond to the certification authority of PEM, and a reliable third person guarantees validity of the public-key by issuing a public-key certificate with digital signature to the data such as name of the public-key. In this PGP, there is a method called electronic fingerprinting to easily confirm the public-key. By this method, the public-key is hashed by one-way hash function such as MD 5 (Message Digest 5), and 16-byte hash value is confirmed by voice.

When PEM is compared with PGP, there is no problem on the certifier in PEM, which adopts hierarchical structure, but this is not necessarily a commonly used system in the Internet System, which is based on grass-roots concept. On the other hand, PGP is a simplified system, which can be widely used. However, this cannot be utilized in case there is no reliable person to sign.

With recent development of computer network system, individual computers, used on stand-alone basis in the past, are connected together through the network system, and database system to commonly share the data is now propagated. Further, distributed object system has been proposed, in which application program or basic software called operating system as well as data is also commonly shared through the network.

In the distributed object system, both data and software are supplied by a server as an object, which comprises program and data. In the distributed object system, there are two systems, i.e. a system called object container, in which operating system, application program and data are provided by a server and data processing and data storage are performed by a user terminal unit, which is an ordinary computer, and a system called server object, in which operating system, application program and data are provided by a server, and data processing is performed by a user terminal unit called network computer, while data storage is carried out by a server. The server object system is further developed to a system, in which data processing is also performed by the server, and the user terminal unit is provided only with input/output function, and the whole system functions as a single computer.

Another form of the network system called "license network" as rental network system, is considered. In this system, an enterprise providing network base such as communication lines also provides the systems other than communication lines such as fee charging system, security system, copyright management system, certification system, etc. And a service enterprise utilizes these services and carries out network business as if it is his own system.

SUMMARY OF THE INVENTION

In the present application, the inventor proposes a data management system for protecting copyright of digital data, for maintaining security in electronic commerce data and keeping security for digital cash data in an ordinary computer network system, a distributed object system and a license network system.

A first aspect of the data management system of the present invention comprises a data management center on a network, an original copyright owner or an information provider and a plurality of users who use the network. The data management center certifies public-key of network users, distributes secret-key for data encryption corresponding to presentation of a user label, and identifies data utilization status by the request of the secret-key. The data is stored and transferred after having been encrypted using the secret-key, and the data is to be stored and transferred encrypted using a secret-key different from the secret-key for the data which has been transferred. An original data label is added to an original data, and an edit label is added to an edited data. The data management center does not store the data but stores only the original data label and the data relating to editing. A user label is used to request the secret-key, but electronic fingerprinting of the user label may be used instead.

The second aspect of the data management system comprises a data management center on a network, an original copyright owner or an information provider and a plurality of users utilizing the network. The data management center certifies the public-key of the network users, and stores the original data and the editing scenario, and further stores the us r label, the original data label and edit label. The data is not trans-

ferred between the users and the data label encrypted by the public-key is transferred. For transfer and for request of utilization, the data label is used, while electronic fingerprinting of the data label may be used instead.

In electronic commerce system, every data is distributed through a mediator on a network, data which is transferred from a maker to a user is encrypted by a secret-key for encryption, and data which is transferred from the user to the maker is encrypted by a secret-key for re-encryption.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1A to Fig. 1D each represents a drawing for explaining labels;
Fig. 2A to Fig. 2D each represents a drawing for explaining label, data header and data body;
Fig. 3A to Fig. 3D each represents a drawing for explaining encryption of data and label;
Fig. 4A to Fig. 4G each represents a drawing for explaining encryption of data header and data body;
Fig. 5A to Fig. 5C each represents a drawing for explaining encryption of label, data header and data body;
Fig. 6A and Fig. 6B each represents a drawing for explaining encryption of object file;
Fig. 7 represents a conceptional structure of a data management system of a first embodiment of the present invention;
Fig. 8 represents a conceptional structure of a data management system of a second embodiment of the present invention;
Fig. 9 is to explain a technique to generate data from a plurality of data;
Fig. 10 represents a conceptional structure of a data management system of a third embodiment of the present invention;
Fig. 11 represents a conceptional structure of a data management system of a fourth embodiment of the present invention;
Fig. 12A and Fig. 12B each represents a conceptional structure of a data management system of a fifth embodiment of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

To begin with the description of embodiments according to the present invention, from first embodiment to fifth embodiment, basic explanation for these embodiments are described hereinafter.

--Certifier--

In the present invention, it is necessary to have an entity, which certifies copyright owner of original copyrighted data, an information provider (IP) of the original copyrighted data, a user of the original copyrighted data and those who edit the original copyrighted data. There may be a single certifier or a plurality of certifiers. In case a plurality of certifiers are present, they can be virtually considered as a single entity by linking them with each other.

In this system, a set of public-key & private-key of each user and a secret-key different for each step of the use of the copyrighted data are used. Among these keys, the private-key is managed under responsibility of each user and corresponding public-key is performed digital signature by the certifier, so that the reliability is maintained. The public-key is controlled by a key management center generally called key library and is distributed at the request of the user, while it is possible to link a certifier having certifying function with the key management center or to make the certifier also have a function of the key management center.

--Crypt Key--

Brief description will be given on a key system and a digital signature system used in the invention.

Secret-key system is also called "common key system" because the same key is used for encryption and decryption. Because it is necessary to keep the key in secret, it is also called "secret-key system". Typical examples of encryption algorithm using secret-key are: DES (Data Encryption Standard) system of National Bureau of Standards, FEAL (Fast Encryption Algorithm) system of NTT, and MISTY system of Mitsubishi Electric Corp. In the embodiments described below, the secret-key is referred as "Ks".

In contrast, the public-key system is a cryptosystem using a public-key being made public and a private-key, which is maintained in secret to those other than the owner of the key. One key is used for encryption and the other key is used for decryption. Typical example is RSA public-key system. In the embodiments described below, the public-key is referred as "Kb", and the private-key is referred as "Kv".

Here, the operation to encrypt a data M as data material to a cryptogram Ck using a crypt key K is expressed as:

$$Ck = E(M, K)$$

and the operation to decrypt the cryptogram Ck to the data M using a crypt key K is expressed as:

$$M = D(Ck, K).$$

Digital signature is a technique applying the public-key system. In this system, a transfer source turns the data M to a hash value Hm by one-way hash function such as MD 5. Using a private-key Kv, the hash value Hm is encrypted to ChmKv and is transferred together

with the data M to a transfer destination. The transfer destination decrypts the transferred encrypted hash value Chmkv to the hash value Hm using the public-key Kb and also turns the transferred data M to a hash value Hm' using the same one-way hash function. If Hm = Hm', it is judged that the transferred data is reliable. The hash value Hm obtained in this process can be uniquely obtained from the data M, and it is not possible to uniquely reproduce the data M from the hash value Hm.

In case the transfer source and the transfer destination can confirm each other, the reliability of the transfer data is maintained even when the hash value Hm is transferred without encrypting. This is called electronic fingerprinting and is used for simplified certification.

--Use of Keys--

In the embodiments from first to fifth, encryption/decryption/re-encryption of data, storing inhibition of data, and storing of crypt keys are performed in devices other than those in a center. These operations are desirable to be operated by automatically working unique application program, by application program contained in data, or for attaining higher security by operating system. It can be further attained higher security to perform these processings by using IC card or PC card.

--Charging--

To ensure to charge and collect a fee corresponding to the use of data, there are two methods: to charge a fee corresponding to the expected use prior to actual use, and to charge a fee corresponding to actual result of use after the use.

The method to charge a fee after the use can be implemented by metering bill payment in which the use results are recorded and the fee is charged by checking the record of use, or by card prepayment in which a card with an amount of purchase entered in advance on it is used to be subtracted by the entered amount corresponding to the actual use.

Further, the metering bill payment method is divided into two methods to install a recording unit on server side like charging for telephone calls and to install a recording unit on user terminal like charging electric fees.

The card prepayment method is divided into two methods in which prepayment is stored on server side as a credit card; and the prepayment is stored on user side as a prepaid card.

--Storing of Keys--

In first to fourth embodiments, based on user information presented by the user when the user registers utilization of th system, the data management center prepares a user label and transmits it to the user. The user stores the user label, and a user's public-key, a user's private-key and a public-key of the data management center which are used in the system, in the user's own device. The optimal place for this storage is an IC card or a PC card, while it is also possible to store in a data storage unit in the device. A manner of storing crypt keys by IC card or PC card can ensure the higher security than that of managing keys by operating system.

In the following, description will be given on a system to manage data copyrights, while there are digital data other than copyrighted data, requiring confidentiality, certainty and reliability of communication contents, dealing contents, etc. such as electronic commerce data or digital cash data, and the present invention can also be applied to these digital data.

In the network system using crypt key, an entity to store the crypt key and an entity to generate the crypt key are placed out of the network system and are utilized via the network system. In the embodiment described below, it is supposed that a single entity, i.e. data management center, serves as all of these entities.

--Label--

In the present invention, labels are used to protect copyright of the data and to execute data copyright. First, description will be given on the labels, referring to Figs. 1, 2 and 3.

In this system, a user label of the system user is used. On the user label, information of the label owner is described as shown in Fig. 1A. In case the label owner has the original copyright, information relating the original copyrighted data is added as shown in Fig. 1B. In case the copyrighted data is an edited copyrighed data obtained by editing the original copyrighted data, information relating to the data of original copyright, information of edit tool and editing data (editing scenario) are further added as shown in Fig. 1C. It is also possible to add the edit tool (editing program) instead of the edit tool information as shown in Fig. 1D.

Among these labels, the label where only information of the label owner as shown in Fig. 1A is described is referred as "user label", and the label with information relating copyrighted data as shown in Fig. 1B is referred as "copyright label", and the label with information of the editing scenario is referred as "edit label" as shown in Fig. 1C or Fig. 1D.

The user label is generated by the data management center according to the information of the user when the user joins the system. The copyright label is generated by the data management center when the author of the data presents the content to the data management center. The edit label is generated by the data management center, when the user who has edited the data presents the user label and th editing scenario to the data management center. These are transferred to

each label owner and are stored at the data management center.

--Encrypting--

Figs. 2A, 2B and 2C each represents relationship between copyright label and copyrighted data.

In the copyright label and copyrighted data corresponding to the label, the copyright label is separated from header of the data as shown in Fig. 2A, of is integrated with header of the data as shown in Fig. 2B, or is bonded to the header as shown in Fig. 2C.

In case the copyright label is bonded to the header, it is possible to have extended label arrangement, in which a plurality of copyright labels are combined together as shown in Fig. 2D. In case where label is integrated as shown in Fig. 2B, if the copyright label becomes larger, label may not be accommodated in a single header which is limited in capacity. In the extended label arrangement by combining a plurality of labels as shown in Fig. 2D, if there are too many labels, it exceeds the limit of packet size on Internet, and this causes difficulty in distribution.

There is a case where the copyright label is encrypted and used as shown in Fig. 3A and a case where it is used without being encrypted as shown in Fig. 3B. In these figures, square framed portions show being encrypted. In case the copyright label is not encrypted, the data copyrighted is encrypted. Even in case where the copyright label is not encrypted, the copyright labels other than the finally added copyright label are encrypted in the extended label arrangement as shown in Fig. 2D and a multi-stage arrangement can be adopted, in which crypt key of the copyright labels added previously and encrypted is included in the copyright label added later as shown in Fig. 3C and Fig. 3D. By this arrangement, it is possible to confirm the content of the previously added copyright labels.

Data is encrypted and decrypted to protect the copyright, but encryption and decryption are tasks which apply much burden on computers. In case the data to be encrypted or decrypted is a text data mainly composed of characters, the burden of encryption and decryption is not so much, but in case the data to be encrypted or decrypted is audio data or picture data, especially moving picture data, the burden of encryption and decryption may be enormous. For this reason, even in case high speed crypt algorithm is used, as special type computer such as super-parallel type super-computer is necessary rather than generally used personal computers, at present, it is not practical in softwear to encrypt or decrypt the data other than text data i.e., moving piture data in real-time by softwear.

Description will be given now on an arrangement of encryption and decryption of data referring to Figs. 4A, 4B, 4C, 4D, 4E, 4F and 4G. In thes figures, squar framed portions ar the portions to be encrypted.

Fig. 4A shows a method to use cryption in principle. Only data body, overwhelmingly larger compared with a header portion, is encrypted, and the data header to be used to recognize the data is not encrypted. In this arrangement, the burden of encryption and decryption is very high.

In contrast, there is a method to encrypt the data header portion without encrypting the data body portion as shown in Fig. 4B. In this case, if the entire header is encrypted, the data cannot be recognized. Hence, a part of the header is not encrypted.

As a method to reduce the burden in the arrangement of Fig. 4A, only the forward portion of the data body can be encrypted as shown in Fig. 4C. In this arrangement, it is only a part of the data body which must be encrypted or decrypted, and the burden of encryption and decryption is extremely reduced.

Fig. 4D shows the case where the effect by the arrangement of Fig. 4C is increased more, and a plurality of encrypted portions of the data body are provided in the data body.

Fig. 4E shows a method called SKIP (Simple Key-management for Internet Protocols). Here, data body is encrypted, and a part of the header is encrypted, whereby crypt key for decrypting the data body is placed in the encrypted portion in the header. In this arrangement, it is extremely difficult to cryptanalyze because two pieces of cryption must be decrypted.

However, in case of the arrangement shown in Fig. 4E, the entire data body is encrypted, and the burden of encryption and decryption is very high as in the case of the arrangement shown in Fig. 4A. If the arrangement of Fig. 4E is combined together with the arrangement of Fig. 4C and only the forward portion of the data body is encrypted as shown in Fig. 4F, the burden of encryption and decryption is extremely reduced because it is necessary to encrypt or decrypt only a part of the data body.

In the arrangement of Fig. 4E, if a plurality of encrypted portions are provided in the data body as shown in Fig. 4G by combining with the arrangement of Fig. 4D, the effect is increased more.

Description regarding an encryption/decryption structure of data having general file form will be given referring to Figs. 5A, 5B and 5C. In these figures, square framed portions are to be encrypted.

Data having general file form consists of data body portion and data header portion, and further, copyright label connecting with or relating to, according to the present invention. Fig. 5A shows a method to use cryption in principle. Only data body is encrypted, and copyright label and data header are not encrypted, and similar to the arrangement of Fig. 4A, the burden of encryption and decryption is very high.

In contrast, there is a method to encrypt the data header portion without encrypting the data body portion as shown in Fig. 5B. In this case, if the entire header is encrypted, the data cannot be recognized. Henc , a part of the header is not encrypted. In this case, the

copyright label also is not encrypted.

There is another method to encrypt the copyright label without encrypting the data body and data header portions as shown in Fig. 5C. In this case also, if the entire copyright label is encrypted, the relation to data which corresponds to the copyright label cannot be recognized. Hence, a part of the copyright label is not encrypted.

Further, there is a method of so-called object oriented programming performing various processings by using "object" integrated with data and program which handles data, instead of general form file consisting of data header and data body. The object has basic conceptual structure as shown in Fig. 6A. A storing portion called as "slot" in an envelope called as "instance" accomodates data called as "instance variable". The slot is surrounded by one or more of procedures called as "method" for referring, processing, binding and so on, and the instance variable can be referred to or operated only via "method". This function is called as "encapsulation". Instruction from outside to make the "method" refer to or operate the instance variable is called as "message".

This means, in another view, the instance variable which is impossible to be referred to or operated without through "method" is protected by the "method". Then, this can be used for encrypting the "method" and allowing the instance variable to be referred to or operated only by "message" which can decrypt the encrypted "method" as shown in Fig. 6B. In this case also, similarly to the case of data having general file form in Fig. 5C, since if entire "method" is encrypted, it is impossible to utilize "object", a part of the "method" is not encrypted. In Fig. 6B, square flamed portion is encrypted.

[1st Embodiment]

Description will be given on a first embodiment referring to Fig. 7.

To explain the principle, description is given first on a case where the user transfers original copyrighted data to the next user without editing it. The case where the user edits the original copyrighted data will be described later. Practically, the case where the original copyrighted data is not edited is combined with the case where the original copyrighted data is edited, and carried out as explained in the third embodiment. In the system of the present embodiment, secret-key and public-key & private-key are used. Therefore, an entity to manage public-key and an entity to generate secret-key may be linked to or included in the data management center.

(1) An original author (data owner) A presents an original copyright label L0 and requests the data management center Cd to distribute an original secret-key Ks0. The original author may transfer or deposit the original copyrighted data to an information provider (IP) or to database so that the information provider or the database can play a role of the original author. It is also possible that the original author A stores the origins secret-key Ks0 and encrypts the original copyrighted data M0 without depending on the data management center Cd, while the original secret-key Ks0 must be stored at the data management center Cd to utilize the original copyrighted data M0 by the user (data user).

(2) When the distribution of the original secret-key Ks0 is requested, the data management center Cd encrypts the original secret-key Ks0 corresponding to the original copyright label L0 using a public-key Kba of the original author A:

$$Cks0kba = E (Ks0, Kba)$$

and distributes the encrypted original secret-key Cks0kba together with the original copyright label L0 to the original author A.

The secret-key is hereafter, encrypted by a public-key of a distributed destination in order to be decrypted only by the distributed destination.

In this case, the data management center Cd performs one-way hash on the original copyright label L0 using algorithm such as MD 5 and prepares an original copyright label fingerprint F0, e.g. the one having 16-byte data, and distributes it to the original author A. Thereafter, this electronic fingerprint is transferred together with the copyrighted data.

(3) When the encrypted original secret-key Cks0kba is distributed, the original author A decrypts the encrypted original secret-key Cks0kba using the private-key Kva of the original author A:

$$Ks0 = D (Cks0kba, Kva),$$

encrypts the original copyrighted data M0 using the decrypted original secret-key Ks0:

$$Cm0ks0 = E (M0, Ks0),$$

and transfers the encrypted original copyrighted data Cm0ks0, the original copyright label L0 and the original copyright label fingerprint F0 to a first user U1.

(4) When the encrypted original copyrighted data Cm0ks0, the original copyright label L0 and the original copyright label fingerprint F0 are transferred, the first user U1 presents the original copyright label L0, the original copyright label fingerprint F0 and first user label Lu1, and requests the data management center Cd to distribute the original secret-key Ks0 and a first secret-key Ks1.

(5) When requested to distribute the original secret-key Ks0 and the first secret-key Ks1, the data management center Cd confirms validity of the presented original copyright label L0 by the original copyright label fingerprint F0, and registers the first user label Lu1. At the same time, the original secret-key Ks0 corresponding to the original copyright label L0 and the first secret-key Ks1 corresponding to the first user label Lu1 are encrypted using public-key Kb1 of the first user U1:

$$Cks0kb1 = E (Ks0, Kb1)$$

$$Cks1kb1 = E (Ks1, Kb1)$$

and distributes the encrypted original secret-key Cks0kb1 and the encrypted first secret-key Cks1kb1 to the first user U1.

(6) When the encrypted original secret-key Cks0ksb1 and the encrypted first secret-key Cks1kb1 are distributed, the first user U1 decrypts the encrypted original secret-key Ck0kb1 and the encrypted first secret-key Cks1kb1 using private-key Kv1 of the first user U1:

$$Ks0 = D (Cks0kb1, Kv1)$$

$$Ks1 = D (Cks1kb1, Kv1).$$

Then, the encrypted original copyrighted data Cm0ks0 is decrypted using the decrypted original secret-key Ks0:

$$M0 = D (Cm0ks0, Ks0)$$

and the decrypted origins copyrighted data M0 is utilized.

In case the original copyrighted data M0 is stored or copied, it is encrypted using the decrypted first secret-key Ks1:

$$Cm0ks1 = E (M0, Ks1).$$

This is stored or copied as the encrypted original copyrighted data Cm0ks1. In case the original copyrighted data M0 is to be transferred to a second user (next data user) U2, it is encrypted using the decrypted first secret-key Ks1 and is transferred as the encrypted original copyrighted data Cm0ks1, together with the original copyright label L0, the original copyright label fingerprint F0 and the first user label Lu1.

Each user may put digital signature which one-way hash value of the user's label is encrypted using user's private-key on the user's label to be presented to the data management center Cd. Then, the data management center decrypts the encrypted one-way hash value using the user's public-key, calculates the one-way hash value of the label and compares the two one-way hash values in order to verity the validity of each user's label.

(7) When the encrypted original copyrighted data Cm0ks1, the original copyright label L0, the original copyright label fingerprint F0 and the first user label Lu1 are transferred, the second user U2 presents the original copyright label L0, the original copyright label fingerprint F0, the first user label Lu1 and second user label Lu2, and requests the data management center Cd to distribute the first secret-key Ks1 and second secret-key Ks2.

(8) When requested to distribute the first secret-key Ks1 and the second secret-key Ks2, the data management center Cd confirms validity of the original copyright label L0 and the first user label Lu1 by the original copyright label fingerprint F0.

When it is confirmed that the first user label Lu1 is valid, the data management center Cd registers the second user label Lu2 and encrypts the first secret-key Ks1 corresponding to the first user label Lu1 and the second secret-key Ks2 corresponding to the second user label Lu2 using public-key Kb2 of the second user U2:

$$Cks1kb2 = E (Ks1, Kb2)$$

$$Cks2kb2 = E (Ks2, Kb2)$$

and distributes the encrypted first secret-key Cks1kb2 and the encrypted second secret-key Cks2kb2 to the second user U2.

(9) When the encrypted first secret-key Cks1kb2 and the encrypted second secret-key Cks2kb2 are distributed, the second user U2 decrypts the encrypted first secret-key Cks1kb2 and the encrypted second secret-key Cks2kb2 using private-key Kv2 of the second user U2:

$$Ks1 = D (Cks1kb2, Kv2)$$

$$Ks2 = D (Cks2kb2, Kv2),$$

decrypts the encrypted original copyrighted data Cm0ks1 using the decrypted first secret-key Ks1:

$$M0 = D (Cm0ks1, Ks1)$$

and utilizes the decrypted original copyrighted data M0.

In case the original copyrighted data M0 is to be stored or copied, it is encrypted using the decrypted second secret-key Ks2, and the encrypted original copyrighted data Cm0ks2 is stored or copied. In case the original copyrighted

data M0 is to be transferred to a third user U3, it is encrypted using the decrypted second secret-key Ks2, and the encrypted original copyrighted data Cm0ks2 is transferred to the third user U3 together with the original copyright label L0, the original copyright label fingerprint F0, the first user label Lu1, and the second user label Lu2.

(10) When the encrypted original copyrighted data Cm0ks2 is transferred together with the original copyright label L0, the original copyright label fingerprint F0, the first user label Lu1 and the second user label Lu2, the third user U3 presents the original copyright label L0, the original copyright label fingerprint F0, the first user label Lu1, the second user label Lu2 and third user label Lu3, and requests the data management center Cd to distribute the second secret-key Ks2 and third secret-key Ks3.

(11) When requested to distribute the second secret-key Ks2 and the third secret-key Ks3, the data management center Cd confirms whether the original copyright label L0, the first user label Lu1 and the second user label Lu2 are valid or not, using the original copyright label fingerprint F0.

When it is confirmed that the second user label Lu2 is valid, the data management center Cd registers the third user label Lu3 and encrypts the second secret-key Ks2 corresponding to the second user label Lu2 and third secret-key Ks3 corresponding to the third user label Lu3 respectively using public-key Kb3 of the third user U3:

$$Cks2kb3 = E (Ks2, Kb3)$$

$$Cks3kb3 = E (Ks3, Kb3).$$

Then, the encrypted second secret-key Cks2kb3 and the encrypted third secret-key Cks3kb3 are distributed to the third user U3.

(12) When the encrypted second secret-key Cks2kb3 and the encrypted third secret-key Cks3kb3 are distributed, the third user U3 decrypts the encrypted second secret-key Cks2kb3 and the encrypted third secret-key Cks3kb3 using private-key Kv3 of the third user U3:

$$Ks2 = D (Cks2kb3, Kv3)$$

$$Ks3 = D (Cks3kb3, Kv3)$$

and decrypts the encrypted original copyrighted data Cm0ks2 using the decrypted second secret-key Ks2:

$$M0 = D (Cm0ks2, Ks2),$$

thus utilizes the decrypted original copyrighted data M0.

In case the original copyrighted data M0 is to be stored or copied, it is encrypted using the decrypted third secret-key Ks3, and the encrypted original copyrighted data Cm0ks3 is stored or copied. In case the original copyrighted data M0 is to be transferred to a fourth user U4, it is encrypted using the decrypted third secret-key Ks3, and encrypted original copyrighted data Cm0ks3 is transferred to the fourth user U4 together with the original copyright label L0, the first user label Lu1, the second user label Lu2 and the third user label Lu3.

Then, the same operation is repeated.

[2nd Embodiment]

Description will be given on a second embodiment, in which the key used to encrypt the copyrighted data is sent separately from the key used for decrypting the copyrighted data, referring to Fig. 8. In the second embodiment, handling of keys, relationship between the original author, the information provider and the users as well as handling of labels are the same as in the first embodiment, and detailed description is not given here.

(1) The original author A presents the original copyright label L0 and requests the data management center Cd to distribute original secret-key Ks0.

(2) When requested to distribute the original secret-key Ks0, the data management center Cd prepares an original copyright label fingerprint F0 from the original copyright label L0, and encrypts the original secret-key Ks0 corresponding to the original copyright label L0 using public-key Kba of the original author A:

$$Cks0kba = E (Ks0, Kba),$$

and distributes the encrypted original secret-key Cks0kba together with the original copyright label L0 to the original author A.

(3) When the encrypted original secret-key Cks0kba is distributed, the original author A decrypts the encrypted original secret-key Cks0kba using private-key Kva of the original author A:

$$Ks0 = D (Cks0kba, Kva)$$

and encrypts the original copyrighted data M0 using the decrypted original secret-key Ks0:

$$Cm0ks0 = E (M0, Ks0).$$

Then, the encrypted original copyrighted data

Cm0ks0, the original copyright label L0 and the original copyright label fingerprint F0 are transferred to the first user U1.

(4) When the encrypted original copyrighted data Cm0ks0, the original copyright label L0 and the original copyright label fingerprint F0 are transferred, the first user U1 presents the original copyright label L0, the original copyright label fingerprint F0 and first user label Lu1, and requests the data management center Cd to distribute the original secret-key Ks0.

(5) When requested to distribute the original secret-key Ks0, the data management center Cd confirms validity of the presented original copyright label L0 using the original copyright label fingerprint F0 and registers the first user label Lu1. At the same time, the original secret-key Ks0 corresponding to the original copyright label L0 is encrypted using public-key Kb1 of the first user U1:

$$Cks0kb1 = E (Ks0, Kb1)$$

and the encrypted original secret-key Cks0kb1 is distributed to the first user U1.

(6) When the encrypted original secret-key Cks0kb1 is distributed, the first user U1 decrypts the encrypted original secret-key Ck0kb1 using private-key Kv1 of the first user U1:

$$Ks0 = D (Cks0kb1, Kv1),$$

decrypts the encrypted original copyrighted data Cm0ks0 using the decrypted original secret-key Ks0:

$$M0 = D (Cm0ks0, Ks0),$$

and utilizes the decrypted original copyrighted data M0.

(7) In case the original copyrighted data M0 is to be stored or copied, the original copyright label L0 and the original copyright label fingerprint F0, and the first user label Lu1 are presented again, and the distribution of the first secret-key Ks1 is requested to the data management center Cd.

(8) When requested to distribute the first secret-key Ks1, the data management center Cd confirms validity of the presented first user label Lu1 using the original copyright label fingerprint F0, and encrypts the first secret-key Ks1 corresponding to the registered first user label Lu1 using public-key Kb1 of the first user U1:

$$Cks1kb1 = E (Ks1, Kb1)$$

and distributes the encrypted first secret-key Cks1kb1 to the first user U1.

(9) When the encrypted first secret-key Cks1kb1 is distributed, the first user U1 decrypts the encrypted first secret-key Cks1kb1 using private-key Kv1 of the first user U1:

$$Ks1 = D (Cks1kb1, Kv1)$$

and encrypts the original copyrighted data M0 using the decrypted first secret-key Ks1:

$$Cm0ks1 = E (M0, Ks1).$$

Then, the encrypted original copyrighted data Cm0ks1 is stored or copied. In case the original copyrighted data M0 is to be transferred to the second user U2, it is encrypted using the decrypted first secret-key Ks1, and the encrypted original copyrighted data Cm0ks1 is transferred together with the original copyright label L0, the original copyright label fingerprint F0, and the first user label Lu1.

(10) When the encrypted original copyrighted data Cm0ks1, the original copyright label L0, the original copyright label fingerprint F0 and the first user label Lu1 are transferred, the second user U2 presents the original copyright label L0, the original copyright label fingerprint F0, the first user label Lu1, and the second user label Lu2, and requests the data management center Cd to distribute the first secret-key Ks1.

(11) When requested to distribute the first secret-key Ks1, the data management center Cd confirms validity of the original copyright label L0 and the first user label Lu1 using the original copyright label fingerprint F0.

When it is confirmed that the first user label Lu1 is valid, the data management center Cd registers the second user label Lu2, encrypts the first secret-key Ks1 corresponding to the first user label Lu1 using public-key Kb2 of the second user:

$$Cks1kb2 = E (Ks1, Kb2)$$

and distributes the encrypted first secret-key Cks1kb2 to the second user U2.

(12) When the encrypted first secret-key Cks1kb2 is distributed, the second user U2 decrypts the encrypted first secret-key Cks1kb2 using private-key Kv2 of the second user U2:

$$Ks1 = D (Cks1kb2, Kv2),$$

decrypts the encrypted original copyrighted data Cm0ks1 using the decrypted first secret-key Ks1:

$$M0 = D (Cm0ks1, Ks1)$$

and utilizes the decrypted original copyrighted data M0.

(13) In case the original copyrighted data M0 is to be stored or copied, the original copyright label L0, the original copyright label fingerprint F0, the first user label Lu1 and the second user label Lu2 are presented again, and the distribution of second secret-key Ks2 is requested to the data management center Cd.

(14) When requested to distribute the second secret-key Ks2, the data management center Cd confirms validity of the presented second user label Lu2 using the original copyright label fingerprint F0, encrypts the second secret-key Ks2 corresponding to the registered second user label Lu2 using public-key Kb2 of the second user U2:

$$Cks2kb2 = E (Ks2, Kb2)$$

and distributes the encrypted second secret-key Cks2kb2 to the second user U2.

(15) When the encrypted second secret-key Ckskb2 is distributed, the second user U2 decrypts the encrypted second secret-key Cks2kb2 using private-key Kv2 of the second user U2:

$$Ks2 = D (Cks2kb2, Kv2),$$

encrypts the original copyrighted data M0 using the decrypted second secret-key Ks2:

$$Cm0ks2 = E (M0, Ks2),$$

and stores or copies it as the encrypted original copyrighted data Cm0ks2. In case the original copyrighted data M0 is to be transferred to the third user U3, it is encrypted using the decrypted second secret-key Ks2, and is transferred as the encrypted original copyrighted data Cm0ks2 together with the original copyright label L0, the original copyright label fingerprint F0, the first user label Lu1, and the second user label Lu2 to the third user U3.

(16) When the encrypted original copyrighted data Cm0ks2 is transferred together with the original copyright label L0, the original copyright label fingerprint F0, the first user label Lu1 and the second user label Lu2, the third user U3 pres nts the original copyright label L0, the original copyright label fingerprint F0, the first user label Lu1, the second user label Lu2 and the third user label Lu3 and requests the data management center Cd to distribute the second secret-key Ks2.

(17) When requested to distribute the second secret-key Ks2, the data management center Cd confirms whether the original copyright label L0, the first user label Lu1 and the second user label Lu2 are valid or not using the original copyright label fingerprint F0.

When it is confirmed that the second user label Lu2 is valid, the data management center Cd registers the third user label Lu3, encrypts the second secret-key Ks2 corresponding to the second user label Lu2 using public-key Kb3 of the third user U3:

$$Cks2kb3 = E (Ks2, Kb3)$$

and distributes the encrypted second secret-key Cks2kb3 to the third user U3.

(18) When the encrypted second secret-key Cks2kb3 is distributed, the third user U3 decrypts the encrypted second secret-key Cks2kb3 using private-key Kv3 of the third user U3:

$$Ks2 = D (Cks2kb3, Kv3),$$

decrypts the encrypted original copyrighted data Cm0ks2 using the decrypted second secret-key Ks2:

$$M0 = D (Cm0ks2, Ks2)$$

and utilizes the decrypted original copyrighted data M0.

(19) In case the original copyrighted data M0 is stored and copied, the original copyright label L0, the original copyright label fingerprint F0, the first user label Lu1, the second user label Lu2 and the third user label Lu3 are presented again, and the distribution of the third secret-key Ks3 is requested to the data management center Cd.

(20) When requested to distribute the third secret-key Ks3, the data management center Cd confirms validity of the presented third user label Lu3 using the original copyright label fingerprint F0. The third secret-key Ks3 corresponding to the registered third user label Lu3 is encrypted using public-key Kb3 of the third user U3:

$$Cks3kb3 = E (Ks3, Kb3)$$

and the encrypted third secret-key Cks3kb3 is distributed to the third user U3.

(21) When the encrypted third secret-key Cks3kb3 is distributed, the third user U3 decrypts the encrypted third secret-key Cks3kb3 using private-key Kv3 of the third user U3:

$$Ks3 = K(Cks3kb3, Kv3),$$

encrypts the original copyrighted data M0 using the decrypted third secret-key ks3:

$$Cm0ks3 = E(M0, Ks3),$$

and stores and copies it as the encrypted original copyrighted data Cm0ks3. In case the original copyrighted data M0 is transferred to the fourth user U4, it is encrypted using the decrypted third secret-key Ks3 and is transferred to the fourth user U4 as the encrypted original copyrighted data Cm0ks3 together with the original copyright label L0, the original copyright label fingerprint F0, the first user label Lu1, the second user label Lu2, and the third user label Lu3.

Then, the same operation is repeated.

In the above-mentioned embodiment, only the keys for decryption necessary for utilization of the copyrighted data are distributed at first. Accordingly, the operation is simplified for the user, who does not store, copy or transfer the copyrighted data.

It is also possible to simultaneously provide two systems so that the two systems can be adequately selected and utilized, i.e. a system where the keys for re-encryption are distributed at the same time as the keys for decryption as in the first embodiment, and a system where keys for re-encryption are separately distributed from those for decryption as in the second embodiment.

[3rd Embodiment]

Description will be given now on a third embodiment where the user edits an original copyrighted data and transfers it to the next user, referring to Fig. 9 and Fig. 10.

The edit processing of the copyrighted data is performed by editing the original copyrighted data using an edit tool, which is an application program. The data of the edited copyrighted data obtained by editing can be expressed by data of the utilized original copyrighted data, the information of the used edit tool and the editing process data. Specifically, in case the edit tool is available, it is possible to reproduce the edited copyrighted data by obtaining the original copyrighted data and the editing process data.

Description on editing digital data will be given.

Because digital data is edited by using an editing program (edit tool) and thereby altering riginal data, edited data can be reproduced as the original data, edit tool and editing process data (editing scenario) are specified. In other words, unless the original data, edit tool and the editing scenario are specified, it is impossible to reproduce the edited data.

To produce new data from single original data, there are a case in which edited data {A'} is obtained by altering original data A; a case in which edited data {A + X} is obtained by adding data X to the original data A by a user; a case in which edited data {A''} is obtained by dividing the original data A into original data elements A1, A2, A3, ... and changing the arrangement of the elements to such as A3, A2 and A1; and a case in which edited data {A1 + X1 + A2 + X2 + A3 + X3 ... ...} is obtained by dividing the original data A into original data elements A1, A2, A3, ..., also dividing the data X of the user into X1, X2, X3, ... and arranging these elements.

In these cases, alteration of original data, change of original data arrangement, combination of the original data with user data, and division of the original data and combination of it with the user data arise respectively a secondary exploitation right as a secondary copyright, which is necessary to be protected. The original copyright of the user, of course, exists in the data X added by the user.

To produce new data by combining a plurality of original data, there are a case in which edited data {A + B + C .....} is obtained by simply combining original data A, B, C, ...; a case in which edited data such as {A + X} is obtained by adding data X to the original data A, B, C, ...; a case in which edited data {A1 + B1 + C1 + ... + A2 + B2 + C2 + ... + A3 + B3 + C3 + ...} is obtained by dividing the original data A, B, C, ... into original data elements A1, A2, A3, ..., B1, B2, B3, ..., and C1, C2, C3, ..., combining them, and changing their arrangements; and a case in which edited data {A1 + B1 + C1 + X1 + ... + A2 + B2 + C2 + X2 + ... + A3 + B3 + C3 + X3 + ...} is obtained by dividing the original data A, B, C, ... into original data elements A1, A2, A3, ..., B1, B2, B3, ..., and C1, C2, C3, ..., combining with the elements of user data X1, X2, X3, ..., and changing their arrangements.

Also in these cases, combination of a plurality of original data, combination of a plurality of original data with user data, division of a plurality of original data and change of the arrangements, and combination of divided plurality of original data with the user data arise respectively a secondary exploitation right as a secondary copyright, which is necessary to be protected. Also, the original copyright of the user, of course, exists in the data X1, X2, X3, ... added by the user.

Fig. 9 shows an example for producing new data D by using a plurality of original data A, B and C. This method is known as the cut-and-paste technique in which data is edited by extracting (cutting out) elements "a", "b" and "c" from original data A, B and C and attaching (pasting) the extracted elements "a", "b" and "c" to form a piece of data D.

Further, there is a data linkage technique which links a plurality of data objects. In this data linkage technique, object linkage part is arranged in "slot" of data object referred to as "pad". The "pad" is linked with other "pad" by the "slot", the peration of which is called "slot connection" so that the objects are linked with each other. Inter-relationship of a plurality of objects linked in this way is represented by a tree structure, and thus represented tree structure can be used for deletion or addition of the object.

While it is clear that original data and user data are data, the editing process: alteration of original data, arrangement change of original data, combination of original data with user data, division of original data and combination with user data, combination of a plurality of original data each other, combination of a plurality of original data with user data, division and arrangement change of a plurality of original data, and combination of divided plurality of original data with user data, are also data.

When noticing that editing scenario of data, such as arrangement of original data and process of editing, is also data, the secondary copyright on edited data can be protected by managing the user's copyright about data of editing process in addition to the original copyright of the author on the original data and the user's copyright on the user's data.

That is, it is possible to ensure to manage the copyrights of edited data as well as of original data, if it is regarded that the edited data is constituted of original data, user data and editing scenario, and thus, by managing these original data, user data and editing scenario. In this case, the editing program used for editing data may be managed by the data management system of data copyrights, if necessary.

While the above data editing of original data can be performed by using an editing program corresponding to the original data, by handling the original data as object-oriented software which has recently been focused on, it is possible to facilitate further editing of data and manage more preferably copyrights of data. Moreover, by adopting agent-oriented software, a user can synthesize data with little labor.

The agent-oriented software, unlike the conventional one, is a program having autonomy, flexibility and cooperativeness, which is able to meet a user's request with its characteristics of autonomy, flexibility and cooperativeness in accordance with only a general instruction of the user without specifically giving every operation instruction to the software.

By incorporating the agent program into a basic system of a data copyright management system so that the database utilization of a user is watched, and it is arranged that information including data utilization condition and charging is collected at the database or the copyright management cent r, using metering function placed in user terminal, and thus, it is possibl to know the database utilization condition of the user at the database side or the copyright management center side and achieve more accurate copyright management. These agent program and its data are also necessary to be protected in copyrights, and therefore, are encrypted like original data.

In this third embodiment shown in Fig. 10, the copyright label in the first and the second embodiments already described added with the editing scenario is called "edit label", and this is treated in the same manner as the copyright label in the first embodiment. The handling of keys, relationship between the original author, the information provider, and the user, as well as the handling of labels are the same as m the first embodiment, and detailed description is not given here.

(1) The original author A presents the original copyright label L0 and requests the data management center Cd to distribute original secret-key Ks0.

(2) When requested to distribute the original secret-key Ks0, the data management center Cd encrypts the original secret-key Ks0 corresponding to the original copyright label L0 using public-key Kba of the original author A:

$$Cks0kba = E (Ks0, Kba)$$

and distributes the encrypted original secret-key Cks0kba together with the original copyright label L0 to the original author A.

In this case, the data management center Cd performs one-way hash to the original copyright label L0 using algorithm such as MD 5, for example, to 16-byte data amount, prepares an original copyright label fingerprint F0, and distributes it to the original author A. This electronic fingerprint is prepared on each of the original copyrighted data and edited copyrighted data each time the original copyrighted data is edited and edited copyrighted data is obtained and is transferred, together with the copyrighted data.

(3) When the encrypted original secret-key Cks0kba is distributed, the original author A decrypts the encrypted original secret-key Cks0kba using private-key Kva of the original author A:

$$Ks0 = D (Cks0kba, Kva),$$

encrypts the original copyrighted data M0 using the decrypted original secret-key Ks0:

$$Cm0ks0 = E (M0, Ks0)$$

and transfers the encrypted original copyrighted data Cm0ks0, the original copyright label L0 and the original copyright label fingerprint F0 to the first user U1.

(4) When the encrypted original copyrighted data Cm0ks0, the original copyright label L0 and the original copyright label fingerprint F0 are transferred, the first user U1 presents the original copyright label L0, the original copyright label fingerprint F0 and first user label Lu1 and requests the data management center Cd to distribute the original secret-key Ks0.

(5) When requested to distribute the original secret-key ks0, the data management center Cd confirms validity of the presented original copyright label L0 using the original copyright label fingerprint F0 and registers the first user label Lu1. At the same time, the original secret-key Ks0 corresponding to the original copyright label L0 is encrypted using public-key Kb1 of the first user U1:

$$Cks0kb1 = E (Ks0, Kb1)$$

and the encrypted original secret-key Cks0kb1 is distributed to the first user U1.

(6) When the encrypted original secret-key Cks0kb1 is distributed, the first user U1 decrypts the encrypted original secret-key Cks0kb1 using private-key Kv1 of the first user U1:

$$Ks0 = D (Cks0kb1, Kv1),$$

decrypts the encrypted original copyrighted data Cm0ks0 using the decrypted original secret-key Ks0:

$$M0 = D (Cm0ks0, Ks0),$$

and edits the decrypted original copyrighted data M0 using the edit tool and obtains edited copyrighted data Me1.

The edited copyrighted data Me1 thus obtained contains copyright of the first user, who edited the data, and also copyright of the original author who prepared the original copyrighted data. The copyright of the original author relating to the original copyrighted data M0 can be protected by the original copyright label L0 which has been registered, original copyright label fingerprint F0 and the original secret-key Ks0 corresponding to the original copyright label L0 and also by the first user label Lu1 and the first secret-key Ks1 corresponding to the first user label Lu1. However, because no key for encrypting the edited copyrighted data Me1 is available, the secondary copyright of the first user relating to the edited copyrighted data Me1 is not yet protected.

(7) To protect the secondary copyright of the first user relating to the edited copyrighted data Me1, label of the first user, who is the author of the edited copyrighted data, and its electronic fingerprinting are used in the third embodiment.

As already described, the edited copyrighted data can be expressed by data of the utilized original copyrighted data, information of the used edit tool and the editing scenario (editing process data). Accordingly, these informations and data are entered in the first user label, i.e. the first edit label Le1. Further, to protect secondary exploitation right as the secondary copyright in subsequent distribution process, the user U1 presents the first edit label Le1 to the data management center Cd so that the secondary copyright of the user U1 is registered.

(8) When the first edit label Le1 is presented, the data management center Cd confirms validity of the presented original copyright label L0 using the original copyright label fingerprint F0 and registers the first edit label Le1. At the same time, the electronic fingerprint Fe1 of the first edit label Le1 is prepared, and first edit secret-key Kse1 corresponding to the first edit label Le1 is encrypted by public-key Kb1 of the first user U1 at the data management center:

$$Ckse1kb1 = E (Kse1, Kb1),$$

and the encrypted first edit secret-key Ckse1kb1 is distributed to the first user U1 together with the electronic fingerprint Fe1 of the first edit label Le1.

(9) When the encrypted first edit secret-key Ckse1kb1 and the electronic fingerprint Fe1 of the first edit label Le1 are distributed, the first user U1 decrypts the encrypted first edit secret-key Ckse1kb1 using private-key Kv1 of the first user U1:

$$Kse1 = D (Ckse1kb1, Kv1),$$

encrypts the first edited copyrighted data Me1 using the decrypted first edit secret-key Kse1:

$$Cme1kse1 = E (Me1, Kse1)$$

and transfers the encrypted first edited copyrighted data Cme1kse1 to the second user U2 together with the first edit label Le1, and the electronic fingerprint Fe1 of the first edit label Le1.

Then, the same operation is repeated.

In the third embodiment, only the first edit label Le1 and the electronic fingerprint Fe1 of the first edit label Le1 are transferred together with the encrypted first edited copyrighted data Cme1kse1 when edited data transfer, while it is possible to arrange in such manner that the other labels and electronic fingerprints can be simultaneously transferred.

In the editing by utilizing a plurality of copyrighted data as shown in Fig. 9, operation is complicated because there are a large numbers of copyrighted data and it can be carried out as in the editing process using a single data. Description is not given here to avoid lengthy explanation.

In the systems of the first, the second and the third embodiments described above, the copyrighted data is encrypted using secret-key, and the secret-key for its decryption and secret-key for re-encryption used for storage, copying and transfer are distributed by the data management center based on the user label presented by the user.

The secret-key for decryption and the secret-key for re-encryption are encrypted by the user public-key, whose validity have been certified by the data management center in advance. Thus, these secret-keys are indirectly certified by the data management center. Because these secret-keys are used to encrypt the copyrighted data to be transferred, the copyrighted data to be transferred consequently is also certified by the data management center. Because certification by the data management center is of absolute nature, it is a hierarchical type certification system represented by PEM.

On the other hand, the copyrighted data itself is transferred between the users without being transferred to the data management center, and that might well be said that the certification carried out in this process is a horizontal distributed type certification system represented by PGP.

As described above, it is possible by the system of the embodiments to attain a certification system, which has high reliability of the hierarchical type certification system and easiness to handle of the horizontal distributed type certification system.

The behavior and content of behavior of the users who utilize the copyrighted data are all identified at the data management center by the user labels presented by the users. The utilization including editing of the copyrighted data is carried out via the data management center. Thus, the identity of the user can be reliably confirmed. By confirming the contents and course of behavior, contents and history of the copyrighted data can be certified. In this certification of the contents is applied to the electronic commerce, it is possible to certify the contents of dealings by the data management center, i.e. to perform "electronic notarization".

When digital signature is put on user label or on edit label, and if computer virus enters the user label or the edit label, the data of the label changes. As a result, hash value changes. Therefore, by verifying the digital signature, it is possible to detect intrusion of computer virus. Even when digital signature is not given, if turning to hash value is performed, the user label or the edit label is made unavailable by the changed hash value, and intrusion of computer virus can be detected.

[4th Embodiment]

In case of distributed object system represented by license network system, the use of network computer to perform only input/output of data and data processing and not provided with data storage unit is adopted instead of conventional type computer, which possesses data storage unit of large capacity. Further, the use of a network computer similar to a terminal unit of large size computer, having only input/output function of data and not provided with data processing unit is also considered. This network computer does not have data storage unit and cannot store or copy the copyrighted data.

Next, description will be given on an embodiment, which can also be applied to a network computer not provided with data storage unit and used in the distributed object system. It is needless to say that this embodiment is also applicable to an ordinary computer provided with data storage unit.

To protect data copyright, it is necessary to use some sort of encryption technique to restrict unauthorized utilization of the copyrighted data. In the first, the second, and the third embodiments described above, to protect copyright in a system for an ordinary computer having data storage unit, encrypted copyrighted data and labels not encrypted as clues to utilize the copyrighted data are used.

In contrast, in a system for a network computer, which has only the function of the above-mentioned terminal unit, the copyrighted data is not stored, copied or transferred, and there is no need to encrypt the copyrighted data.

As already explained in the third embodiment, the editing of copyrighted data is performed by modifying the original copyrighted data using the edit tool, and the edited copyrighted data thus obtained can be expressed by the utilized original copyrighted data, information of the used edit tool and the editing scenario.

This is the same in the distributed object system. In case edited copyrighted data is produced by utilizing the copyrighted data in the database existing on the distributed object system, the edited copyrighted data can be reproduced by specifying the utilized database, the used original copyrighted data, information of the used edit tool and the editing scenario. The same applies to the case where a plurality of copyrighted data obtained from a single database or a plurality of databases are utilized.

Description will be given now on the fourth embodiment referring to Fig. 11.

In this embodiment, the original copyright owner and the information provider (IP) holding the copyrighted data are discriminated from the user who does not hold copyrighted data, and are arranged on the network sid with the data management center and the like. In the system of this mbodiment, public-key and

private-key are used. If original copyrighted data is transferred to a user, the original copyrighted data is encrypted by using a secret-key or a public-key of transferred destination for the purpose of security.

The first user U1 searches the copyrighted data and collects necessary copyrighted data utilizing the network, broadcasting or recording medium. The collected copyrighted data is simply stored temporarily on memory of the user U1. Even when data storage unit such as a hard disk drive is included in the device of the user U1, the copyrighted data is not stored in the data storage unit.

In order that the copyrighted data is not stored, when there is an attempt to store it, inhibition of storage of the copyrighted data is performed by destroying the copyrighted data on memory, changing data header on memory, turning the data to one-way hash value, changing file name to non-storable file name, etc.

While it is possible to inhibit the storage by data storage inhibition program, which is incorporated in the program of the copyrighted data having object structure, higher reliability is accomplished if the storage inhibition is performed by an operating system, which is related to the entire system or to the user's device.

Description will be given on a case where a plurality of copyrighted data are utilized in the fourth embodiment.

(1)(2)The first user U1 presents the first user label Lu1 to the data management center, collects the original copyrighted data M0i (i = 1, 2, 3, ...) from data library of the information provider IP in the system and obtains an edit tool Pe. In this case, the original copyrighted data M0i and the edit tool Pe are encrypted using public-key Kb1 of the first user U1:

$$Cm0ikb1 = E (M0i, Kb1)$$

$$Cpekb1 = E (Pe, Kb1)$$

and the encrypted original copyrighted data Cm0ikb1 and the encrypted edit tool Cpekb1 are distributed to the first user U1.

In this case, the first user label Lu1 is referred, and utilizing conditions of the original copyrighted data M0i and the edit tool Pe are recorded at the data management center and are utilized for charging of a fee.

(3) When the encrypted original copyrighted data Cm0ikb1 and the encrypted edit tool Cpekb1 are distributed, the first user U1 decrypts the distributed encrypted original copyrighted data Cm0ikb1 and the encrypted edit tool Cpekb1 using private-key Kv1 of the first user U1:

$$M0i = D (Cm0ikb1, Kv1)$$

$$Pe = D (Cpekb1, Kv1).$$

Using the decrypted edit tool Pe, the decrypted original copyrighted data M0i is edited, and a first edited copyrighted data M1i (i = 1, 2, 3, ...) is obtained.

(4) Obtaining the first edited copyrighted data M1i, the first user U1 encrypts a first scenario S1i, which is the editing process data for the first edited copyrighted data M1i, using public-key Kbc of the data management center:

$$Cs1ikbc = E (S1i, Kbc)$$

and presents the encrypted first scenario Cs1ikbc together with the first user label Lu1 to the data management center, so that secondary copyright of the user U1 is registered.

(5) When the encrypted first scenario Cs1ikbc is presented, the data management center Cd decrypts the encrypted first scenario Cs1ikbc using private-key Kvc of the data management center:

$$S1i = D (Cs1ikbc, Kvc),$$

prepares a first edit label Le1 based on the presented user label of the first user U1 and the decrypted first scenario S1i, stores it in the data management center Cd, encrypts the first edit label Le1 using public-key Kb1 of the first user U1:

$$Cle1kb1 = E (Lei, Kb1),$$

and transfers the encrypted first edit label Cle1kb1 to the first user U1.

(6) When the encrypted first edit label Cle1kb1 is transferred, the first user U1 decrypts the encrypted first edit label Cle1kb1 using private-key Kv1 of the first user U1:

$$Le1 = D (Cle1kb1, Kv1),$$

encrypts the decrypted first edit label Le1 using public-key Kb2 of the second user U2:

$$Cle1kb2 = E (Le1, Kb2)$$

and transfers the encrypted first edit label Cle1kb2 to the second user U2, but the first edited copyrighted data M1i or the encrypted first edited copyrighted data is not transferred to the second user U2.

When the computer of the first user U1 is provided with a data storage unit, there is possibility that the collected copyrighted data or the edited

copyrighted data may be stored in the storage unit, however, storage inhibition as described above is carried out to exclude storage, copying and transfer.

In this case, it is possible, instead of the encrypted first edit label Cle1kb2, to use electronic fingerprint F1, which is obtained by turning the first edit label to one-way hash value. In so doing, it is possible to perform simplified transfer of the edit label by telephone voice.

(7) When the encrypted first edit label Cle1kb2 is transferred, the second user U2 decrypts the transferred encrypted first edit label Cle1kb2 using the private-key Kv2 of the second user U2:

$$Le1 = D (Cle1kb2, Kv2),$$

encrypts the first edit label Le1 using the private-Key Kv2 of the second user U2:

$$Cle1kv2 = E (Le1, Kv2)$$

and presents the encrypted first edit label Cle1kv2 together with the second user label Lu2 to the data management center Cd.

(8) When the encrypted first edit label Cle1kv2 and the second user label Lu2 are presented, the data management center Cd decrypts the presented encrypted first edit label Cle1kv2 using public-key Kb2 of the second user U2:

$$Le1 = D (Cle1kv2, Kb2),$$

collects the original copyrighted data M0i shown on the decrypted first edit label Le1, edits the original copyrighted data M0i using the edit tool Pe based on the first scenario S1i described on the first edit label Le1, and reproduces the first edited copyrighted data M1i.

When the first edited copyrighted data M1i is reproduced, the data management center Cd encrypts the first edited copyrighted data M1i and the edit tool Pe using the public-key Kb2 of the second user U2:

$$Cm1ikb2 = E (M1i, Kb2)$$

$$Cpekb2 = E (Pe, Kb2)$$

and transfers the encrypted first edited copyrighted data Cm1ikb2 and the encrypted edit tool Cpekb2 to the second user U2.

(9) When the encrypted first edited copyrighted data Cm1ikb2 and the encrypted edit tool Cpekb2 are distributed, th second user U2 decrypts the distributed encrypted first edited copyrighted data Cm1ikb2 and the encrypted edit tool Cpekb2 using private-key Kv2 of the second user U2:

$$M1i = D (Cm1ikb2, Kv2)$$

$$Pe = D (Cpekb2, Kv2)$$

and edits the decrypted first edited copyrighted data M1i using the decrypted edit tool Pe, and the second edited copyrighted data M2i (i = 1, 2, 3, ...) is obtained.

(10) When the second edited copyrighted data M2i is obtained, the second user U2 encrypts the second scenario S2i, which is editing process data of the second edited copyrighted data M2i, using the public-key Kbc of the data management center:

$$Cs2ikbc = E (S2i, Kbc)$$

and presents the encrypted second scenario Cs2ikbc together with the second user label Lu2 to the data management center Cd.

(11) When the encrypted second scenario Cs2ikbc is presented, the data management center Cd decrypts the encrypted second scenario Cs2ikbc using the private-key Kvc of the data management center Cd:

$$S2i = D (Cs2ikbc, Kvc),$$

prepares a second edit label Le2 based on the presented user label of the second user U2 and the decrypted second scenario S2i, stores it in the data management center Cd, encrypts the second edit label Le2 using public-key Kb2 of the second user U2:

$$Cle2kb2 = E (Le2, Kb2)$$

and transfers the encrypted second edit label Cle2kb2 to the second user U2.

(12) When the encrypted second edit label Cle2kb2 is transferred, the second user U2 decrypts the encrypted second edit label Cle2kb2 using private-key Kv2 of the second user U2:

$$Le2 = D (Cle2kb2, Kv2),$$

encrypts the decrypted second edit label Le2 using public-key Kb3 of the third user U3:

$$Cle2kb3 = E (Le2, Kb3)$$

and transfers the ncrypted second edit label Cle2kb3 to the third user U3. Then, the same oper-

ation is repeated.

In the fourth embodiment using this distributed object system, the copyrighted data is not stored by the user, but it is stored only in the database. On the other hand, the user controls and stores only the edit label, i.e., the information relating to user and editing, which has information of the utilized original copyrighted data and the used edit tool, the editing scenario and the information of the user who has edited. Only this edit label is encrypted and transferred between the users. Therefore, the copyrighted data is not stored, copied or transferred.

Also, in the system of this embodiment, only the public-key and the private-key are used, and validity of this public-key is certified by the data management center in advance, and certification by the data management center is of absolute nature. Accordingly, it is a hierarchical type certification system represented by PEM.

The edit label to be transferred is encrypted by the user's public-key, the validity of which has been certified in advance by the data management center, and it is transferred. Thus, its contents are reliable as it is indirectly certified by the data management center. The edit label itself is transferred between the users without being transferred to the data management center, and it might well be said that it is horizontal distributed type certification system represented by PGP.

As described above, it is possible according to the system of this embodiment to attain a certification system, which has high reliability of the hierarchical type certification system and easiness to handle of the horizontal distributed type certification system.

Behavior and contents of behavior of the users utilizing the copyrighted data are all identified by the user label presented by the users at the data management center. The utilization including editing of the copyrighted data is carried out through the data management center. Accordingly, the identity of each user can be reliably confirmed, and by confirming the contents and the course of behavior, contents and history of the copyrighted data can be certified. When this certification of contents is applied to electronic commerce, it is possible to certify the contents of dealing by the data management center, i.e. to perform "electronic notarization".

Further, in case digital signature is put on the user label or on the edit label, and if computer virus enters the user label or the edit label, the data of the label is changed, and as a result, change occurs in the hash value. Therefore, by verifying digital signature, it is possible to detect intrusion of computer virus. Even when digital signature is not given, if turning to hash value is performed, the user label or the edit label are made unavailable depending upon the changed hash value. Thus, it is possible to detect intrusion of computer virus.

Because behavior and contents of behavior of the users utilizing the copyrighted data are all identified by the user label presented by the users at the data management center, every charging system on the above functions effectively.

[5th Embodiment]

An embodiment in which a system of the present invention is applied to the electronic commerce will be given. A basic case is at first, explained in which all of the processings are performed through mediator as a data management center, referring to Fig. 12A.

(1) User U looks a products catalogue of the mediator S via network, and requests the mediator S electronic commerce data Qm as dealing data including quotation for desired products and information of order form and payment terms.

(2) When requested the electronic commerce data Qm, the mediator S encrypts a request R of the electronic commerce data Qm and first secret-key Ks1 by using public-key Kbm of maker M:

$$Crkbm = E (R, Kbm)$$

$$Cks1kbm = E (Ks1, Kbm)$$

and transfers encrypted request Crkbm and encrypted first secret-key Cks1kbm to the maker M.

(3) When received the encrypted request Crkbm and encrypted first secret-key Cks1kbm, the maker M decrypts the transferred encrypted request Crkbm and encrypted first secret-key Cks1kbm by private-key Kvm of the maker M:

$$R = D (Crkbm, Kvm)$$

$$Ks1 = D (Cks1kbm, Kvm)$$

encrypts electronic commerce data Qm corresponding to the request R by using decrypted first secret-key Ks1:

$$Cqmks1 = E (Am, Ks1)$$

and transfers encrypted electronic commerce data Cqmks1 to the mediator S.

(4) When received the encrypted electronic commerce data Cqmks1, the mediator S decrypts transferred encrypted electronic commerce data Cqmks1 by using the first secret-key Ks1:

$$Qm = D (Cqmks1, Ks1),$$

encrypts again the decrypted electronic commerce

data Qm by using second secret-key Ks2:

$$Cqmks2 = E (Qm, Ks2),$$

encrypts second secret-key Ks2 by using public-key Kbu of the user:

$$Cks2kbu = E (Ks2, Kbu)$$

and transfers encrypted electronic commerce data Cqmks2 and encrypted second secret-key Cks2kbu to the user U.

(5) When received encrypted electronic commerce data Cqmks2 and encrypted second secret-key Cks2kbu, the user U decrypts encrypted second secret-key Cks2kbu by using private-key Kvu of user U:

$$Ks2 = D (Cks2kbu, Kvu),$$

decrypts encrypted electronic commerce data Cqmks2 by using decrypted second secret-key Ks2:

$$Qm = D (Cqmks2, Ks2),$$

edits electronic commerce data Qm by entering order contents into electronic commerce data, makes order sheet Qu, encrypts the order sheet Qu, thus filled in, by using the second secret-key Ks2:

$$Cquks2 = E (Qu, Ks2)$$

and transfers encrypted order sheet Cquks2 to mediator S.

(6) When received encrypted order sheet Cquks2, mediator S decrypts the encrypted order sheet Cquks2 by using the second secret-key Ks2:

$$Qu = D (Cquks2, Ks2),$$

encrypts decrypted order sheet Qu by using public-key Kbm of the maker M:

$$Cqukbm = (Qu, Kbm)$$

and transfers encryptd order sheet Cqukbm to the maker M.

When received encryptd order sheet Cqukbm, the maker M decrypts encryptd order sheet Cqukbm by using private-key Kvm of maker M:

$$Qu = E (Cqukbm, Kvm)$$

and the order is accepted and handled according to order contents of the decrypted order sheet Qu.

Next, an example of exceptional case when a user orders directly to a maker will be explained, referring to Fig. 12B.

In the exceptional case, steps before above-mentioned (4), in which encrypted electronic commerce data Cqmks2 and encrypted second secret-key Cks2kbu are transferred to user U, are same steps as basic case as shown in Fig. 12A. And therefore, same detailed description is not given here, and description of steps different from basic case is given.

(7) When received encrypted electronic commerce data Cqmks2 and encrypted second secret-key Cks2kbu, the user U decrypts encrypted second secret-key Cks2kbu by using private-key Kvu of the user U:

$$Ks2 = D (Cks2kbu, Kvu),$$

decrypts encrypted electronic commerce data Cqmks2 by using decrypted second secret-key Ks2:

$$Qm = D (Cqmks2, Ks2),$$

enters order contents into decrypted electronic commerce data Qm, i.e., performing data editing, makes order sheet Qu, encrypts the order sheet Qu, thus filled in, by using the second secret-key Ks2:

$$Cquks2 = E (Qu, Ks2)$$

and transfers encrypted order sheet Cquks2 to the maker M.

(8) When received encrypted order sheet Cquks2, the maker M transfers the encrypted order sheet Cquks2 to the mediator S.

(9) When received encrypted order sheet Cquks2, the mediator S decrypts the encrypted order sheet Cquks2 by using second secret-key Ks2:

$$Qu = D (Cquks2, Ks2),$$

encrypts decrypted order sheet Qu by using public-key Kbm of maker M:

$$Cqukbm = E (Qu, Kbm)$$

and transfers.it to the maker M.

(10) When received encrypted order sheet Cqukbm, the maker M decrypts the encrypted order sheet Cqukbm by using private-key Kvm of maker

M:

$$Qu = D (Cqukbm, Kvm)$$

and handles the order acording to contents of the order sheet Qu.

In this electronic commerce system, computer softwear handled via network other than commercial products, can be also applied in dealings.

In this case, softwear P is encrypted by maker M by using private-key Kvm of the maker M:

$$Cpkvm = E (P, Kvm),$$

encrypted softwear Cpkvm is transferred to mediator S, encrypted softwear Cpkvm, thus transferred, is decrypted by the mediator S by using public-key Kbm of maker M:

$$P = D (Cpkvm, Kbm),$$

decrypted softwear P is encrypted by the mediator S by using public-key Kbu of user U:

$$Cpkbu = E (P, Kbu),$$

encrypted softwear Cpkbu is transferred to the user U, and the transferred encrypted softwear Cpkbu is decrypted by the user U by using private-key Kvu of user U:

$$P = D (Cpkbu, Kvu).$$

Crypt keys for encrypted softwear which is stored in recording medium such as CD-ROM are distributed on pay basis, and the crypt keys can be further, applied in dealings in the electronic commerce system, in the manner of similar way for computer softwear described above.

In the basic case as described referring to Fig. 12A, since all of the dealing processings are performed through the mediator, various troubles caused in omitting the mediator among dealing processes can be previously prevented. In exceptional case as described referring to Fig. 12B, further, in order that the maker receives the content of order sheet and handles the order, it is necessary that encrypted order sheet is transferred to the mediator and decrypted by the mediator. Therefore, the mediator takes part in the dealing processes without fall in this case also, and thus, vanous troubles caused in omitting the mediator among dealing processes can be previously prevented. The secret-key which is transferred, may be transferred incorporated in electronic commerce data other than transferred alone.

In each embodiment described hereinbefore, while data or label is encrypted/decrypted, the burden of encryption and decryption is rather high. In case that the data and label are transferred via network, these are re-encrypted by secret-key and in addition, are encrypted by public-key. Therefore, in order to utilize the transferred data and label, these are necessary to be decrypted by private-key and in addition, to be decrypted by secret-key.

In order to reduce the burden of encryption and decryption, while partly encrypting is described as shown in Figs. 4A to 4G, if the processing ability of the user device is not high, even when partly encrypting, performing both processings of encryption/decryption by secret-key system, which is for copyright management, and encryption/decryption by public-key system, which is for data security, is yet difficult.

To cope with the above problems, encryption/decryption, which is processing other than encryption/decryption for protecting transferred data or label, may be performed, for example, by an entity in the network, and encrypted/decrypted data or label is transferred to a user. While encryption/decryption for protecting transferred data or label is performed generally by public-key cryptosystem, this encryption/decryption is performed by a device of user.

Above processing of encryption/decryption performed by an entity in the network may be applied to the case of reproduction of edited copyrighted data in the third and forth embodiments.

In the third embodiment, encrypted copyrighted data and non-encrypted edit label including editing scenario are transferred from one user to next user. The non-encrypted edit label and corresponding secret-key are stored in data management center. The next user transfers transferred encrypted copyrighted data and non-encrypted edit label to the data management center, and therefore, the copyrighted data is decrypted, and thus, edited copyrighted data is reproduced based on decrypted copyrighted data and the edit label at the data management center. Then, the edited copyrighted data is transferred to the next user.

In the fourth embodiment, encrypted edit label including editing scenario is only transferred from a user to next user. In contrast, the edit label is stored in the data management center. And therefore, the data management center, by transferred encrypted edit label to the data management center by the next user, collects necessary original data based on the edit label and reproduces edited copyrighted data, and then, transfers the edited copyrighted data to the next user.

Claims

1. Method for managing digital data to be transferred from an owner of data to a user of data via a communication network, with the steps:

   Providing secret-key, public-key, private-key, data owner label, user label and data label;

Linking a data management center to a public-key storage and a secret-key generator and arranging same on said communication network;

Certifying the public-keys of said owner and said user, and storing of said data owner label, said user label and said data label by the data management center;

Presenting said data owner label and data label, and requesting a secret-key for data encryption from said data management center by said owner;

Preparing a data label fingerprint from said data label and transferring secret-key for encryption which is encrypted by using said public-key of owner together with said data label fingerprint to said owner by said data management center;

Encryption of the data using said secret-key which is decrypted by using private-key of said owner, and transfer of said encrypted data, said data label and said data label fingerprint to a first user by said owner

Presenting user label of said first user, said data label and said data label fingerprint, and requests a secret-key for decrypting said encrypted data and a secret-key for re-encrypting said data which is decrypted, to said data management center by said first user;

Confirmation of validity of said data label by said data label fingerprint, registering of said user label of first user, and transfer of said secret-key for decrypting encrypted data and said secret-key for re-encrypting decrypted data, both of which are encypted by using the public-key of said first user, to said first user by said data management center; and

Decryption of said secret-key for decryption and said secret-key for re-encryption by using the private-key of said first user, decryption and use of the encrypted data using said secret-key for decryption, encryption of the decrypted data using said secret-key for re-encryption to be stored and copied, and transfer of the encrypted data together with said data label, said data label fingerprint and said user label of first user to the next user by said first user.

2. Method according to Claim 1, wherein a copyright is registered by presenting said data owner label and said data label to said data management center by said owner of data.

3. Method according to Claim 1, wherein said digital data is edited by the user, and editing scenario of said digital data is added to said data label.

4. Method according to Claim 3, wherein a secondary copyright is registered by presenting the user label of said user and data label having said editing scenario of said digital data to said data management center by said user.

5. Method according to Claim 3 or 4, wherein there is a plurality of said digital data.

6. Method according to Claim 1, 2, 3, 4, or 5 wherein digital signature is performed on said data label.

7. Method according to Claim 1, 2, 3, 4, 5, or 6 wherein charging a fee is performed by presenting the user label of said user and said data label to said data manaement center by said user.

8. Method according to Claim 7, wherein the charging a fee is performed by metering bill payment method based on use results.

9. Method according to Claim 8, wherein the metering data based on use results is stored in said data management center.

10. Method according to Claim 8, wherein the metering data based on use results is stored in a device of said user.

11. Method according to Claim 7, wherein the charging a fee is performed by prepayment method.

12. Method according to Claim 11, wherein the prepayment data is stored in said data management center.

13. Method according to Claim 11, wherein the prepayment data is stored in a device of said user.

14. Method according to Claim 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, or 13, wherein said digital data has general file structure and only the data body thereof is at least partially encrypted.

15. Method according to Claim 14, wherein the part of said data body with encryption is continuously arranged in said data body.

16. Method according to Claim 14, wherein a plurality of parts of said data body with encryption is intermittently arranged in said data body.

17. Method according to Claim 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, or 13, wherein said digital data has general file structure, and data header and data body thereof are encrypted.

18. Method according to Claim 17, wherein a part of said data header and at least part of said data body are encrypted.

19. Method according to Claim 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, or 13, wherein said digital data has general file structure and data header thereof only is encrypted.

20. Method according to Claim 19, wherein at least part of said data header is encrypted.

21. Method according to Claim 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, or 13, wherein said digital data has general file structure, and only label is encrypted.

22. Method according to Claim 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, or 13, wherein said digital data has object-formed file structure, and only method is encrypted.

23. Method for managing digital data to be transferred from an owner of data to a user of data via broadcast, a communication network or data recording medium, using public-key, private-key, user label and data label; with the steps:

Linking a data management center and the owner to a public-key storage, and arranging on said communication network;

Certifying the public-keys of said owner and said user and storage of said user label and said data label by said data management center; and

Obtaining said digital data and data label from said communication network by presenting said user label to use said digital data, which is not stored in a device of said first user after using said digital data by a first user.

24. Method according to Claim 23, wherein said digital data is not stored in the device of said user by deletion of said digital data.

25. Method according to Claim 23, wherein said digital data is not stored in the device of said user by turning said digital data to one-way hash value.

26. Method according to Claim 23, wherein said data management center is further linked to secret-key generator, and said digital data is encrypted by using a secret-key and stored in the device of said user.

27. Method according to Claim 24, 25 or 26, wherein said ditigal data is edited, and edit label is obtained by adding editing scenario of said digital data to said data label.

28. Method according to Claim 27, wherein said edit label is only transferred to next user.

29. Method according to Claim 28, wherein said edit label is encrypted by using public-key of said next user, and is transferred to said next user;

said next user decrypts the encrypted edit label by using private-key of said next user and prensents decrypted said edit label to said data management center;
said data management center transfers the ditital data based on said edit label to said next user;
said next user uses and edits said digital data by editing scenario of said edit label.

30. Method according to Claim 28, wherein said first user transfers said edit label to said next user;

said next user presents said edit label to said data management center;
said data management center transfers said digital data based on said edit label to said next user;
said next user uses and edits said digital data by editing scenario of said edit label.

31. Method according to Claim 30, wherein said first user performs digital signature to said edit label by using private-key of said first user.

32. Method according to Claim 23, 24, 25, 26, 27, 28, 29, 30 or 31, wherein there are a plurality of said digital data.

33. Method according to Claim 23, 24, 25, 26, 27, 28, 29, 30 31 or 32, wherein charging a fee is performed by presenting said user label and said data label to said data management center by said user.

34. Method according to Claim 33, wherein the charging a fee is performed by metering bill payment method based on use results.

35. Method according to Claim 34, wherein the metering data based on use results is stored in said data management center.

36. Method according to Claim 34, wherein the meter-

ing data based on use results is stored in a device of said user.

37. Method according to Claim 33, wherein the charging a fee is performed by prepayment method.

38. Method according to Claim 37, wherein the prepayment data is stored in said data management center.

39. Method according to Claim 37, wherein the prepayment data is stored in a device of said user.

40. Method according to Claim 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38 or 39, wherein said digital data has general file structure and data body thereof only is encrypted.

41. Method according to Claim 40, wherein a part of said data body is encrypted.

42. Method according to Claim 41, wherein the part of said data body with encryption is continuously arranged in said data body.

43. Method according to Claim 41, wherein a plurality of parts of said data body with encryption is intermittently arranged in said data body.

44. Method according to Claim 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, or 43, wherein said digital data has general file structure, and data header and data body thereof are encrypted.

45. Method according to Claim 44, wherein a part of said data header and at least part of said data body are encrypted.

46. Method according to Claim 23, 24, 25, 26, 27, 28, 29, 30 , 31, 32, 33, 34, 35, 36, 37, 38 or 39, wherein said digital data has general file structure and data header thereof only is encrypted.

47. Method according to Claim 46, wherein at least part of said data header is encrypted.

48. Method according to Claim 23, 24, 25, 26, 27, 28, 29, 30, 31 32, 33, 34, 35, 36, 37, 38 or 39, wherein said digital data has general file structure, and only label is encrypted.

49. Method according to Claim 48, wherein a part of said label only is encrypted.

50. Method according to Claim 23, 24, 25, 26, 27, 28, 29, 30 or 31, 31, 32, 33, 34, 35, 36, 37, 38 or 39, wherein said digital data has object-formed file structure, and only method is encrypted.

51. Method for electronic commerce between producer and user via an agency, using secret-key, and public-key and private-key, with the steps;

linking the agency to a public-key storage and a secret-key generator and arranging on a communication network;

Requesting electronic commerce data from said agency by said user;

Transfer of the request of said electronic commerce data together with secret-key for encryption, which is encrypted by using public-key of said producer, to said producer by the agency;

Decryption of encrypted secret-key for encryption by using private-key of said producer, and encryption of said electronic commerce data by using decrypted secret-key for encryption and transfer of the encrypted electronic commerce data to said agency by said producer;

Decryption of said encrypted electronic commerce data by using said secret-key for encryption, re-encryption of decrypted electronic commerce data by using secret-key for re-encryption, and transfer thereof together with said secret-key for re-encryption, which is encrypted by using public-key of said user, to said user by said agency;

Decryption of encrypted secret-key for re-encryption by using private-key of said user, decryption of encrypted electronic commerce data by using decrypted secret-key for re-encryption, making of order sheet by entering order content into decrypted electronic commerce data, encrypting said order sheet by using secret-key for re-encryption, and transfer of encrypted order sheet to said agency by said user;

Decryption of said encrypted order sheet by using said secret-key for re-encryption, encryption of the decrypted order sheet by using public-key of said producer, and transfer of encrypted order sheet to said producer by said agency;

Decryption of the encrypted order sheet by using private-key of said producer, and accepting of the order by said producer.

52. Method for electronic commerce according to Claim 51, wh rein said electronic commerce data has general file structure and data body thereof only is encrypted.

53. Method for electronic commerce according to Claim 52, wherein the part of said data body with encrypted is continuously arranged in said data body.

54. Method for electronic commerce according to Claim 52, wherein a plurality of parts of said data body with encryption is intermittently arranged in said data body.

55. Method for electronic commerce according to Claim 51, wherein said electronic commerce data has general file structure, and at least part of the data header and at least part of the data body thereof are encrypted.

56. Method for electronic commerce according to Claim 51, wherein said electronic commerce data has general file structure and only at least part of the the data header thereof is encrypted.

57. Method for electronic commerce according to Claim 51, wherein said electronic commerce data has general file structure and only at least part of said label is encrypted.

58. Method for electronic commerce according to Claim 51, wherein said electronic commerce data has object-formed file structure and method is encrypted.

Fig. 1A

Fig. 1B

Fig. 1C

Fig. 1D

Fig. 2A

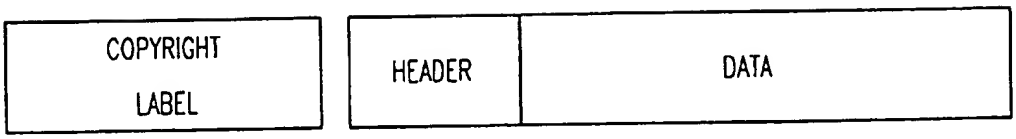


Fig. 2B

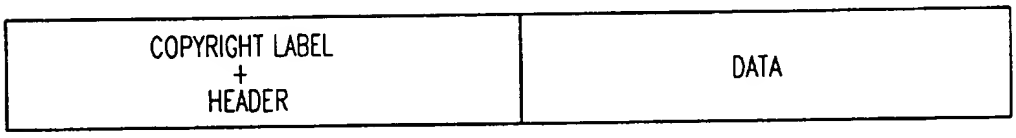


Fig. 2C

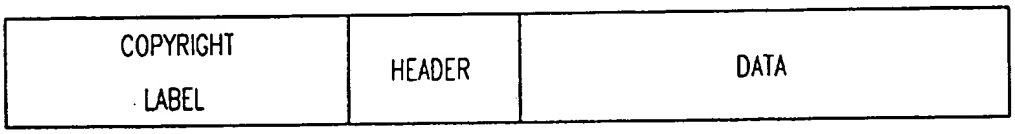


Fig. 2D

Fig. 3A

Fig. 3B

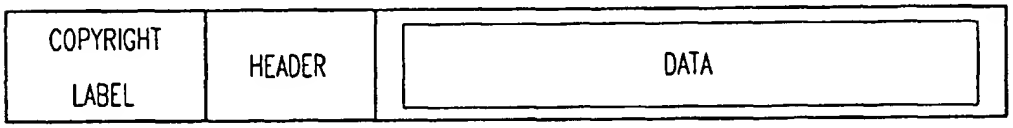


Fig. 3C

Fig. 3D

Fig. 4A

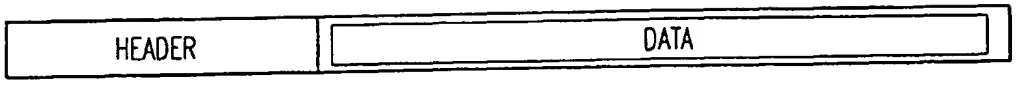


Fig. 4B

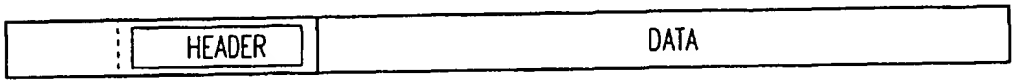


Fig. 4C

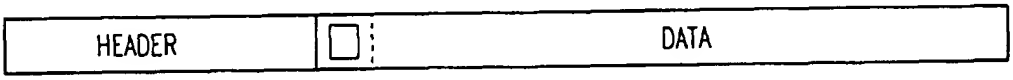


Fig. 4D

Fig. 4E

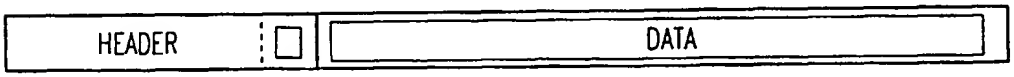


Fig. 4F

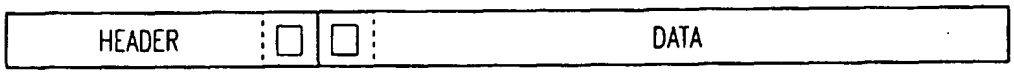
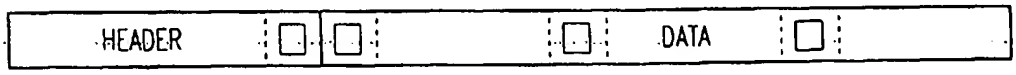


Fig. 4G



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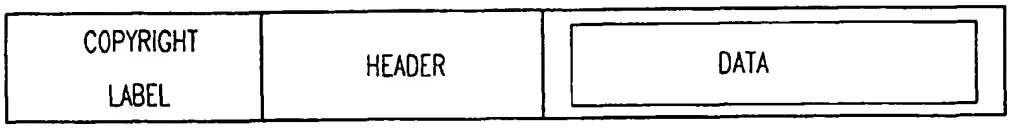


Fig. 5B

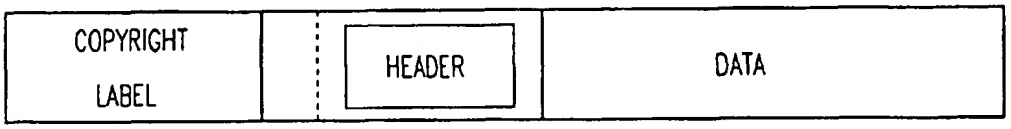
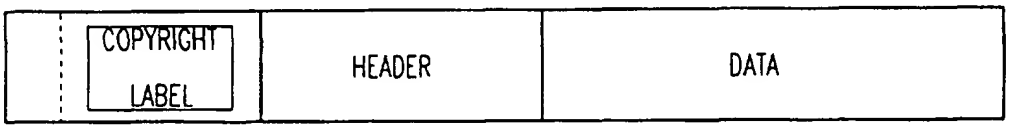


Fig. 5C



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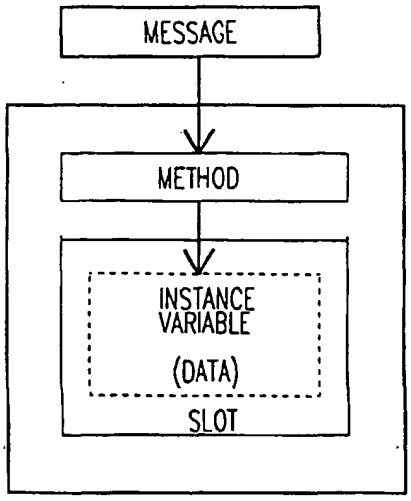

Fig. 6B

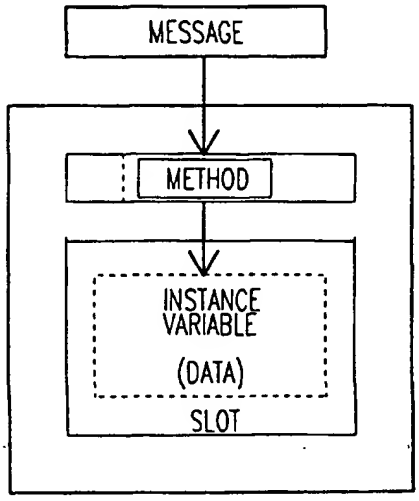

Fig. 7

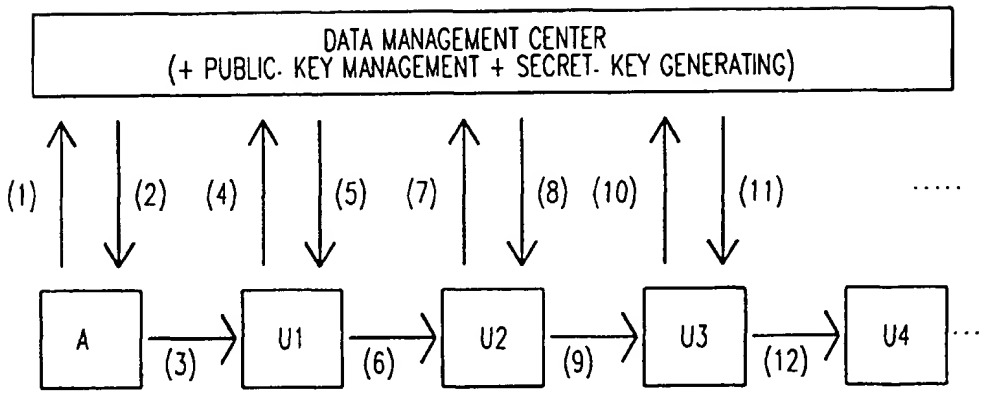
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Fig. 8

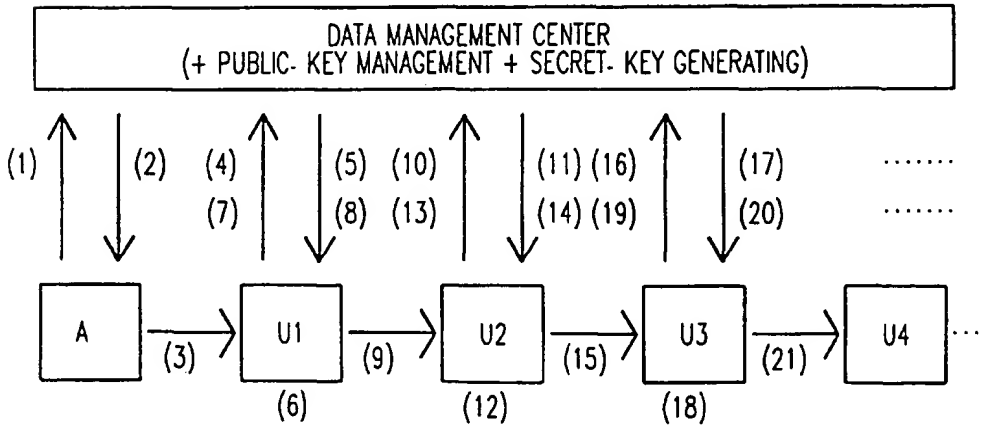
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Fig. 9

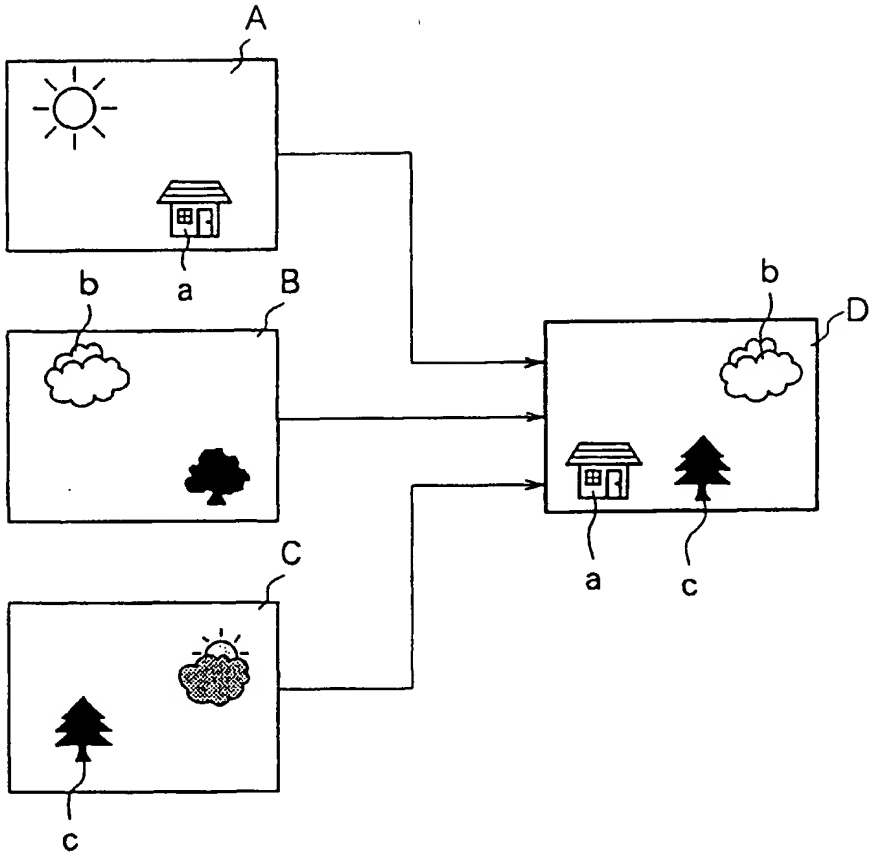

Fig. 10

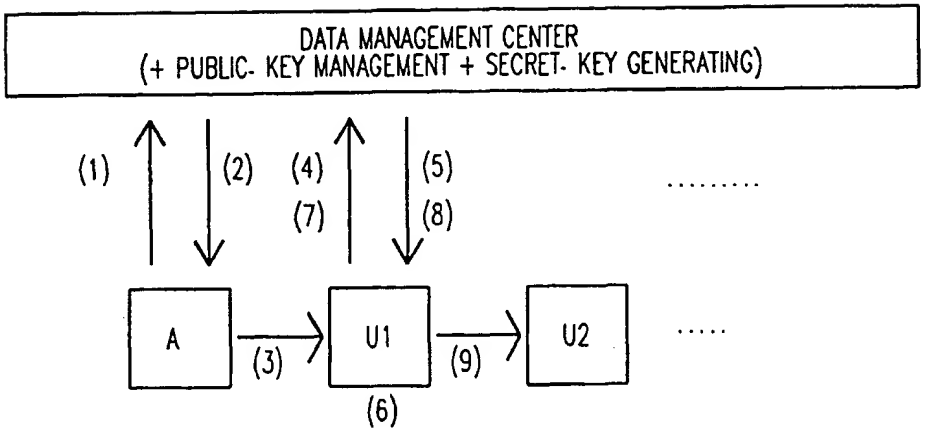
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Fig. 11

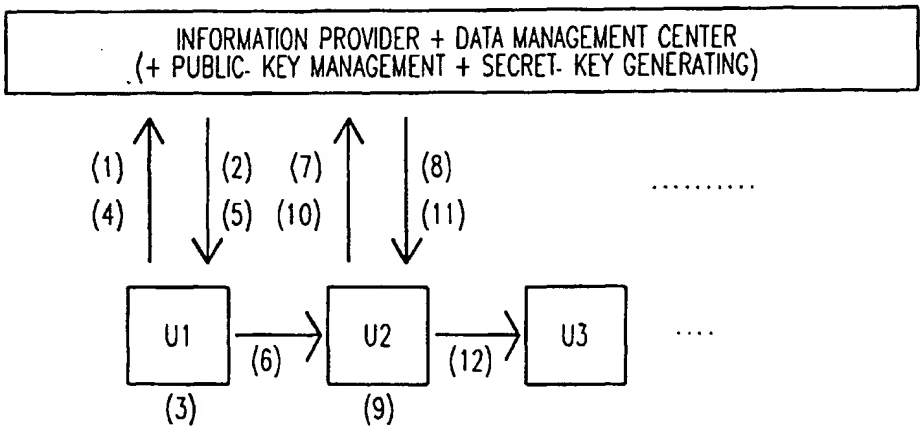
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Fig. 12A

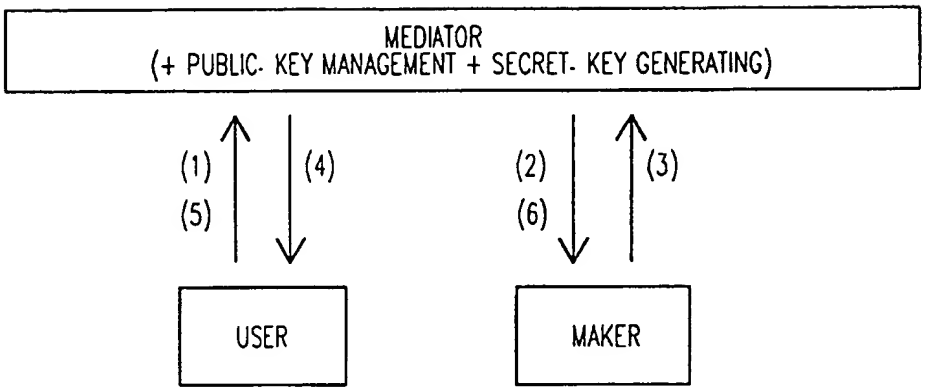
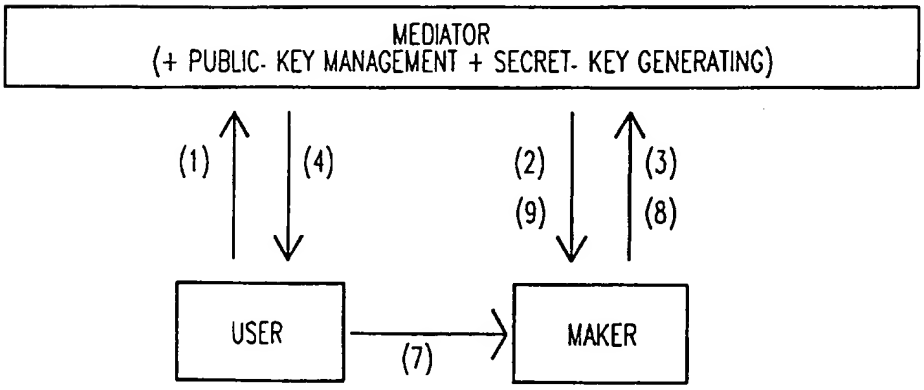


Fig. 12B



(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 0 833 241 A3

(12) EUROPEAN PATENT APPLICATION

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(43) Date of publication A2:
01.04.1998 Bulletin 1998/14

(21) Application number: **97116728.3**

(22) Date of filing: **25.09.1997**

(51) Int. Cl.[6]: **G06F 1/00**

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Designated Extension States:
AL LT LV RO SI

(30) Priority: **27.09.1996 JP 27712596**

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Chiyoda-ku Tokyo 100 (JP)

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Tama-shi, Tokyo (JP)

(74) Representative:
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(54) Secure data management system

(57) The present invention provides a system to ensure security of data in a computer network system. A center certifies a public-key of user of the system and distributes a secret-key. A first system comprises the center in a network, an information provider and a plurality of users. The center identifies utilization status by requests of the secret-key. The data is encrypted by the secret-key and is stored and transferred, while the data to be stored and transferred is encrypted by a secret-key different from the secret-key for the transferred data. An original data label is added to the original data, and an edit label is added to the edited data, and the center does not store the data and stores only the original data label and the edit label. A second system comprises a center and an information provider in a network, and a plurality of users utilizing the network. The center stores the original data and editing scenario, and also the original data label, user label and edit label. The data is not transferred between the users, but data label encrypted by the public-key is transferred. In electronic commerce system, every data is distributed through a mediator in the network, data which is transferred from a maker to a user is encrypted by a secret-key for encryption, and data which is transferred from the user to the maker is encrypted by a secret-key for re-encryption.

Fig. 3A

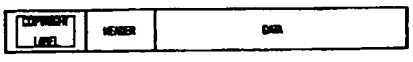

Fig. 3B

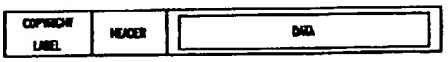

Fig. 3C

Fig. 3D

EP 0 833 241 A3

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 97 11 6728

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
A	EP 0 715 243 A (XEROX CORP.) 5 June 1996 * abstract; figures 1-3,5,6,16,18 *	1,2,5, 7-9,11, 12,14, 23,24, 32-35, 37,38, 51,52, 55,58	G06F1/00
A	US 5 400 403 A (FAHN ET AL.) 21 March 1995 * abstract; figures 1,2,7 *	1,7,11, 13,14, 23,26, 33,37, 39-41, 51,52, 55,58	
A,P	EP 0 746 126 A (MITSUBISHI CORP.) 4 December 1996 * abstract; figures 1,2,5 *	1-5,7, 14,23, 26-30, 32,40, 50-52, 55,58	TECHNICAL FIELDS SEARCHED (Int.Cl.6) G06F
E	WO 97 50036 A (INSTITUTE OF SYSTEMS SCIENCE) 31 December 1997 * claims 1,3-6; figures 1,2,5-8 *	1,2,5, 14,23, 26,32, 51,52, 55,58	

-/--

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
BERLIN	23 June 1999	Taylor, P

CATEGORY OF CITED DOCUMENTS

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EUROPEAN SEARCH REPORT

Application Number
EP 97 11 6728

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
E	EP 0 813 133 A (IBM) 17 December 1997 * abstract; claims 1-5; figures 1-5,8 *	1-3,5,7, 14,23, 26,27, 32,33, 51,52,58	

TECHNICAL FIELDS SEARCHED (Int.Cl.6)

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
BERLIN	23 June 1999	Taylor, P

CATEGORY OF CITED DOCUMENTS

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23-06-1999

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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82